LCLUC Abstract

Assessing Future Stability of U.S. High Plains Landcover: Integration of Process Modeling with Landsat, In Situ Modern and Paleoclimate Data

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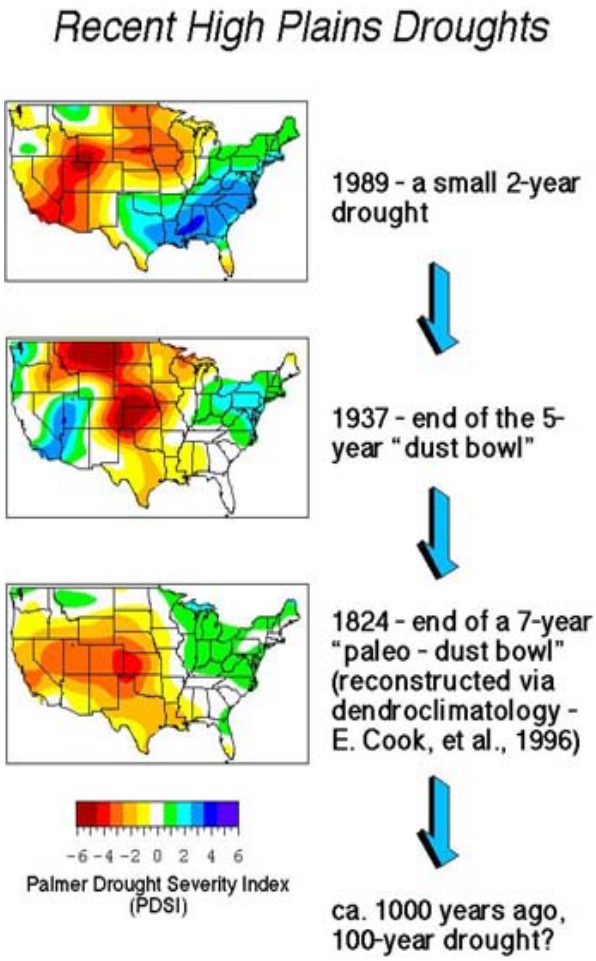

The U.S. High Plains, stretching from Wyoming and Nebraska southward through New Mexico and Texas contains some of the most economically significant, yet potentially endangered land-cover of the country. Land-cover in this region is susceptible to both human land-use and climate-induced land-cover change. Recent (e.g., 1995-6, 1950's and 1930's) climatic extremes (i.e., drought), and their impacts, demonstrate that climate-induced change is the largest threat to land-cover on the over 100,000 km2 of stabilized eolian (wind-generated) deposits of the High-Plains, a fact made even more clear by the paleoclimatic observation that much bigger land-cover change took place prior to significant human land-use than after. Although climatic change, and to an equal extent human land-use, has caused small areas of the High Plains eolian deposits (e.g., sand dunes and sand sheets) to mobilize during the 20th Century, the paleoclimatic record indicates much greater amounts of wind-generated eolian land-cover change took place during the last 10,000 years of interglacial climate. Since this climate regime was not dramatically unlike that of this century, it is likely that a small future shift in climate forcing could have a profound impact of the natural and agricultural land-cover presently stabilizing the over 100,000 km2 of "paleo" eolian deposits. For this reason, it is key that we develop an effective means to assess how this economically critical land-cover will be affected in the future, both by natural (climatic) and human-related processes. Furthermore, a proven assessment strategy for this U.S. region should provide the foundation for similar assessments of how the land-cover of other, "at risk", semi-arid regions around the world might change in the future.

We propose to develop the needed land-cover change assessment strategy by coupling an existing NASA ESE effort ("Land and Land-Use Change in the Climate Sensitive High Plains: An Automated Approach with Landsat;" A. Goetz, PI) with new research focused on the integration of the Landsat data with process modeling to understand the sensitivity of High Plains land-cover to climate and human land-use forcing. More importantly, we will calibrate our model-based assessment methods with paleoclimatic data to ensure that we can simulate the full range of

possible climate-induced land-cover change. The existing ESE program is using Landsat TM data spanning the period 1988 to 1998/98 to develop a land-cover (natural and anthropogentic) GIS database that also includes in situ information on soils, eolian landforms and climate. Our proposed work will build on this effort in several ways. First, our new research will augment the existing ESE effort by collecting/collating field "ground-truth" data needed to characterize the soil, vegetation cover, and recent paleoclimatic history of High-Plains land-cover units defined from Landsat data. Second, our proposed research will integrate climate (GCM and meso-scale) and vegetation/ecosystem (CENTURY) models to simulate the observed relationships between climate, land-cover, and stabilization-status of High-Plains eolian deposits. Our goal is to use the integrated modeling scheme to predict the susceptibility of each High-Plains vegetation and eolian land-cover unit to the full range of possible climatic change. The Landsat-based GIS will then serve to track human-induced land-cover change, and translate our model-based assessments to all land-cover units mapped in the GIS.

From paleoenvironmental data we already know that drought extremes and eolian land-cover change were significantly larger prior to the extensive land-use of the 20th Century. Assessments of future land-cover change that fail to incorporate this fact would obviously be misleading. For this reason, we will couple our assessment models with paleoclimatic data to ensure that our methods are able to simulate the dramatic pre-20th Century climate, vegetation, and eolian land-cover change. Lastly, we will use our "paleo-calibrated" methods to assess the susceptibility of each land-cover unit mapped in our GIS to a range of future climatic changes. We will work with land-use planners/ decision-makers to ensure that our assessments are of maximum economic value.